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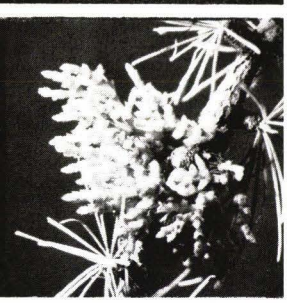

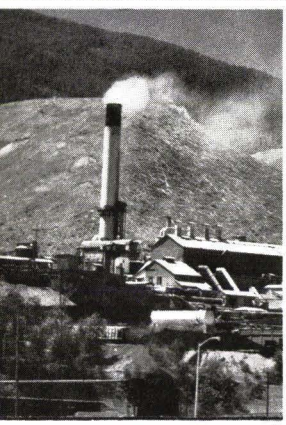

FOREST INSECT & DISEASE MANAGEMENT

USDA · FOREST SERVICE · NORTHERN REGION

State & Private Forestry · Missoula, MT 59801

Report No. 77-5

5200
April 1977

EVALUATION OF MOUNTAIN PINE BEETLE INFESTATIONS Thompson River Drainage, Plains District Lolo National Forest, Montana, 1976

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ABSTRACT

Mountain pine beetle developed to epidemic levels in lodgepole pine stands in the Thompson River drainage in 1971. Approximately 506,616 trees are infested on 4,444 hectares. Based on buildup ratios, infestations are expected to intensify; develop in uninfested stands; and kill about 1,763,024 trees in 1977. Salvage logging of infested trees and silvicultural management to reduce the average stand diameter below 20 cm d.b.h. are recommended to manage the infestation.

INTRODUCTION

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., populations developed to epidemic levels in lodgepole pine, *Pinus contorta* var. *latifolia* Engelm., stands in the Thompson River drainage in 1971 (McGregor et al. 1975). Infestations were first detected in Lazier and Meadow Creek drainages with an estimated 118,486 trees killed, containing approximately 73,821 cu. meters on 750 hectares by 1974. Epidemic infestation now occurs from Deerhorn-Sears Gulch north to Thompson Lakes in the Thompson River drainage. The majority of infested trees occur in the Lazier-Meadow and Fishtrap drainages. Detection surveys indicate that approximately 1,611 ha of National Forest lands; 1,238 ha of U.S. Plywood lands; 1,177 ha of Burlington Northern Inc.; and 417 ha of State and private lands are infested (Figure 1). This is an increase of 3,693 ha of infested area since 1974.

The frequency of epidemics appears to be directly related to site quality, age, phloem thickness, tree diameter distribution within the stand, and elevation and latitude (Amman 1969; 1972; Amman et al. In Press). Stands on better sites become susceptible more

rapidly than those on poor sites. Infestations seldom develop in lodgepole pine stands less than 60 years of age. In stands 60-80 years old, a larger proportion of trees are reaching phloem thickness - tree diameters conducive to outbreak development. Stands greater than 80 years old present the greatest potential for outbreak development. The mountain pine beetle kills proportionately more large than small diameter trees during an infestation, and on the average, kills the largest diameter trees during each successive year of a major infestation. Larger trees generally have thicker phloem, which is directly related to beetle production, resulting in more beetles being produced per sq. cm than in small diameter thin phloem trees. Beetle production is less in trees of dense stands, which usually have thinner bark and phloem ($\leq$ 0.25 cm thick). As larger diameter trees (20 cm d.b.h. and larger) containing thick phloem ($\geq$ 0.25 cm) are depleted from the stand, infestations begin to decline (Amman et al. In Press; Cole and Amman 1969; and Safranyik et al. 1974).

To obtain estimates of number of infested trees/hectare, size of tree attacked, and potential for increase, ground surveys were conducted in McCully, Bear, Indian Prairie, Lazier, and Fishtrap drainages during November-December 1976 (Figure 1).

METHODS

Estimates of number of infested trees/hectare were based on forty 0.10 ha plots at 100-meter intervals in five infested areas. A hypsometer was used to determine if trees occurred within plot boundaries. Each infested tree 13 cm d.b.h. (diameter at breast height) and larger was recorded by d.b.h. and classified into one of the following categories:

0	=	Green, uninfested
1	=	1976 attack; green or partially faded foliage; brood in cambium, blue stain present
2	=	1975 attack; red foliage, brood emerged
3	=	1974 or prior attack; majority of needles dropped
4	=	Unsuccessful attack or pitchout; green foliage, pitchtubes present, brood and blue stain absent.

These data are used for determining buildup ratios of old to newly attacked trees and for predicting additional tree mortality that might occur in 1977. Phloem thickness - tree diameter distribution of lodgepole pine was based on twenty 0.04 ha plots within the remaining green stand. These data aid in determining susceptibility of the remaining lodgepole pine. A hypsometer was used to determine trees to be tallied within plots. Each tree tallied was recorded by d.b.h., and two phloem samples were removed with a hand ax from opposite sides of each of two trees/diameter class/plot. Phloem thickness was measured to the nearest 0.03 cm with a steel ruler.

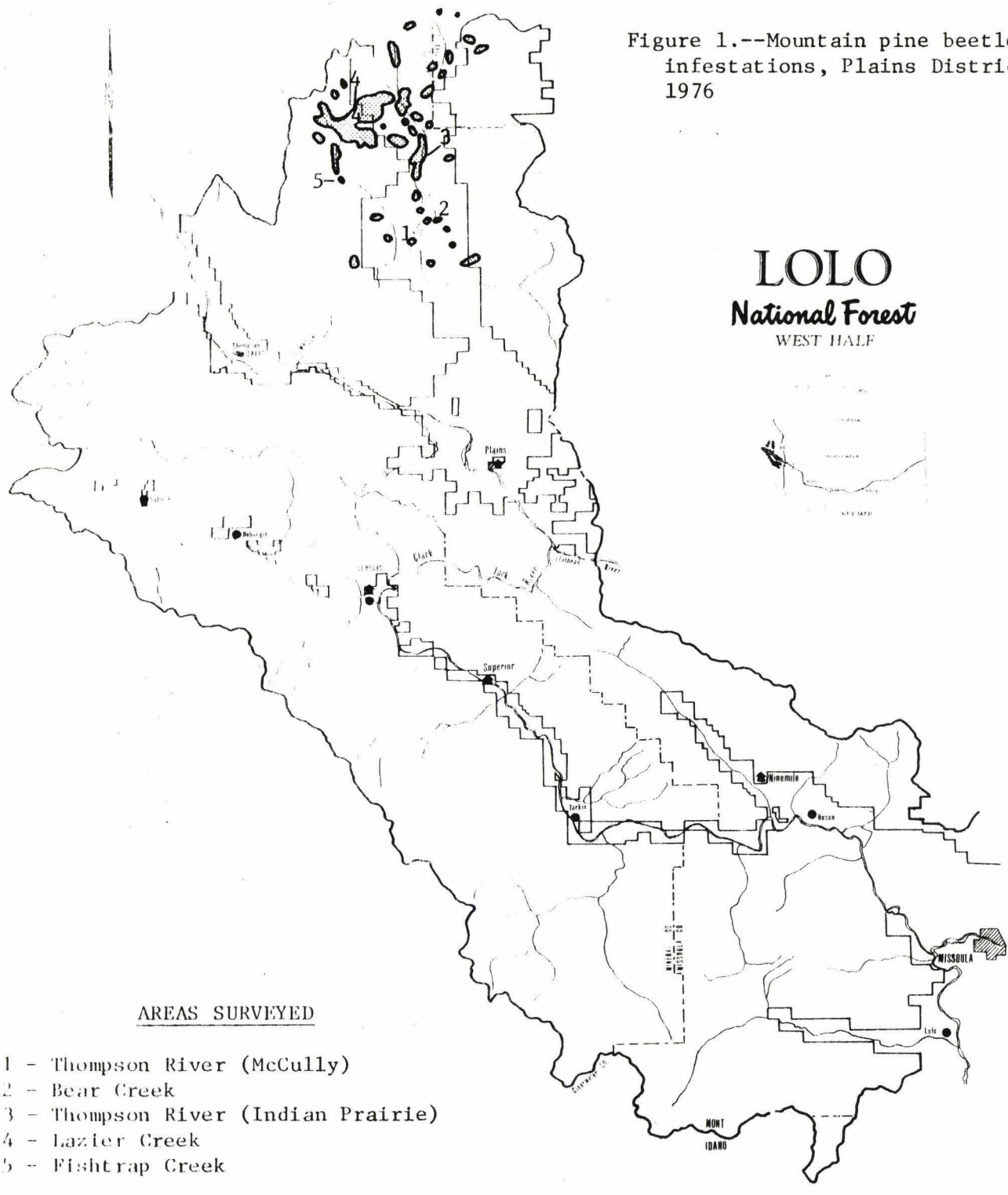

Figure 1.--Mountain pine beetle infestations, Plains District, 1976

RESULTS

Stand descriptions.--Habitat types and species composition of each area surveyed are listed in Table 1.

Table 1.--Habitat types and species composition. McCully, Bear, Indian Prairie, Lazier, Fishtrap drainages, Plains District, Lolo National Forest, 1976.

Area	Habitat Types 1/	Percent Species Composition					
		Pinus contorta var latifolia	*Pseudotsuga menziesii*	*Larix occidentalis*	*Pinus ponderosa*	*Abies lasiocarpa*	*Picea engelmanii*
McCully	Not available	40	60	0	0	0	0
Bear	Not available	84	7	2	7	0	0
Indian Prairie	Not available	67	30	3	0	0	0
Lazier	DF/Twin flower	100	0	0	0	0	0
Fishtrap	DF/Dwarf huckleberry	81	7	4	1	6	1

1/ Pfister et al. 1974.

Infestation intensity.--Infestation intensity by year in areas surveyed is presented in Table 2.

Table 2.--Mountain pine beetle tree loss data; buildup and trend prediction. McCully, Bear, Indian Prairie, Lazier, Fishtrap drainages, Plains District, Lolo National Forest, 1974-1976.

Items	Year	Areas Surveyed				
		McCully	Bear	Indian Prairie	Lazier	Fishtrap
Average d.b.h. of infested trees in centimeters	1974	28	23	23	23	20
	1975	28	28	20	23	20
	1976	28	23	20	20	20
Infested trees/hectare	1974	17	10	32	17	10
	1975	15	20	20	39	22
	1976	27	47	89	259	143
Buildup ratio old:new	1975	1:0.8	1:1.9	1:0.6	1:2.4	1:2.2
	1976	1:1.8	1:2.2	1:4.5	1:6.4	1:6.5
Trend	1975	-	+	-	+	+
	1976	+	+	+	+	+

- = Decrease for those years
+ = Increasing

Buildup ratio in the Thompson River drainage of old to newly infested trees was 1:2.2 from 1972 to 1973; 1:2.2 from 1973 to 1974; 1:1.2 from 1974 to 1975; and 1:3.5 from 1975 to 1976. Currently there is an average of 114 infested trees/ha on about 4,444 ha. This indicates approximately 506,616 trees now infested.

DISCUSSION

The outbreak developed in Lazier and Meadow Creek drainages in 1971. Epidemic infestation has persisted since 1971, with an increase in number of infested trees and hectares infested yearly through 1976.

Amman et al. (In Press) developed a hazard rating system for mountain pine beetle in lodgepole pine stands which includes factors such as: (1) age; (2) elevation; and (3) average d.b.h. for the stands. Outbreaks usually develop in stands 80 years of age or older; at an elevation

where climate is favorable for beetle brood development; and where average d.b.h. of the stand for trees 12.7 cm and larger exceeds 20 cm d.b.h. These factors and buildup ratios were used in hazard rating stands evaluated in the Thompson River drainage.

By multiplying the following factors: 1=low, 2=moderate, and 3=high for age, elevation and average d.b.h., susceptibility classification of the stand is obtained.

Based on this hazard rating system, stands surveyed were rated as shown in Table 3.

Table 3.--Hazard rating for lodgepole pine stands surveyed. Plains District, Lolo National Forest, 1976.

Area	Age	Rating	Elevation (Meters)	Rating	Av d.b.h. (cm)	Rating	Total Rating	Predicted Hazard
McCully	200+	3	1067-1372	3	28	3	High	(27)
Bear	75-90	3	1036-1219	3	21	3	High	(27)
Indian Prairie	75-90	3	914-975	3	24	3	High	(27)
Lazier	85	3	1219-1341	3	18	2	Moderate	(18)
Fishtrap	85	3	1219-1280	3	18	2	Moderate	(18)

Based on buildup ratios from 1974 to 1976 and on the formula $Y^1 = y + bx$ (Baker 1968) where:

Y^1 = the potential cumulative number of trees predicted to be killed through 1977
y = the cumulative number of trees killed through 1976
x = number of trees killed in 1976
x_1 = number of trees killed in 1975
$b = \frac{x}{x_1}$

It is predicted that through 1977, 2,533,600 trees will be killed, of which 1,763,024 will be killed during 1977.

As logging or beetles remove susceptible trees -- those with 0.25 cm thick phloem and greater -- from the stand, the infestation will decline. Based on diameter distribution within infested stands examined, a sufficient number of large diameter lodgepole pine exist to maintain the outbreak at epidemic level at least through 1978.

Plot data show that the remaining susceptible host component within infested stands is 44 percent in McCully; 59 percent in Bear; 44 percent in Indian Prairie; 38 percent in Lazier; and 44 percent in Fishtrap. Also many lodgepole pine stands that are susceptible have not yet been infested.

RECOMMENDATIONS

Applied suppression (chemical or felling and burning) is not recommended. Both methods have had limited success, and serve only as delaying actions and do not lessen stand susceptibility. Amman and Baker (1972) determined that beetle populations decline in approximately the same number of years in both treated and untreated stands.

The most effective method of managing mountain pine beetle is through a combined program of logging infested trees and silvicultural treatment to remove or reduce the inventory of large diameter - thick phloemed, highly susceptible trees (Amman et al. In Press). If this management guideline is followed, beetle populations will probably decline and remain at endemic levels until the average tree diameter of the stand again reaches 20 cm d.b.h. and larger.

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